FEMA/29.FC313

FLOOD INSURANCE STUDY

CITY OF PORT ORANGE, FLORIDA

VOLUSIA COUNTY

JUNE 4, 1990

Federal Emergency Management Agency

COMMUNITY NUMBER - 120313

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

CITY OF PORT ORANGE,
VOLUSIA COUNTY,
FLORIDA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and supersedes a previous Flood Insurance Study for the City of Port Orange, Volusia County, Florida (Reference 1). This information will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by the Federal Emergency Management Agency (FEMA) for purposes of the National Flood Insurance Program for most of the flooding sources within the community. A study titled "Tomoka River and B-19 Canal 100-Year Flood Results for the City of Daytona Beach" by Camp Dresser and McKee (Reference 2), which was prepared for the City of Daytona Beach, contains hydrologic and hydraulic information for the B-19 Canal within the City of Port Orange. The data were identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the National Flood Insurance Program. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, FEMA, Atlanta, Georgia, for consideration for revision of this study.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for all flooding sources within the community, except for the B-19 Canal, were obtained from the Flood Insurance Study for the Unincorporated Areas of Volusia County, Florida

(Reference 3). The hydrologic and hydraulic analyses for the B-19 Canal were obtained from the study titled "Tomoka River and B-19 canal 100-Year Flood Results" (Reference 2).

1.3 Coordination

On August 11, 1987, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Port Orange, Volusia County, Florida. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based on the extent and validity of available existing hydrologic and hydraulic data.

Flooding caused by overflow of Spruce Creek, B-19 Canal, B-19 Canal Tributary No. 1, and B-19 Canal Tributary No. 2 was studied in detail within the community.

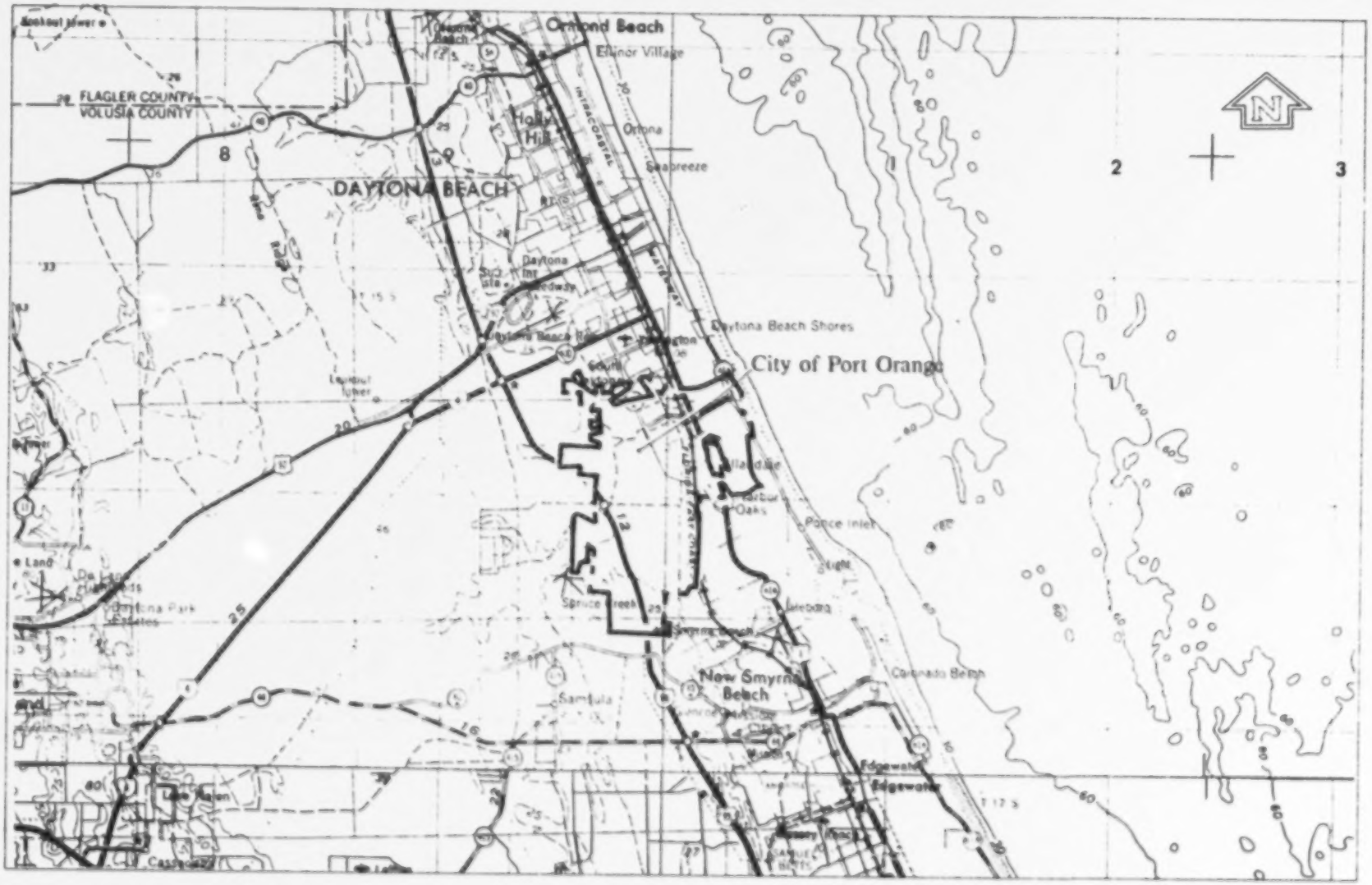
A detailed coastal flooding analysis was performed on the Atlantic Ocean, where flooding propagates inland to affect the City of Port Orange.

Approximate methods of analysis were used to study all remaining areas having a potential flood hazard that did not have detailed scientific or technical data available.

2.2 Community Description

The City of Port Orange is in the eastern portion of Volusia County in eastern Florida. Port Orange is bounded on the north by the unincorporated areas of Volusia County and the City of South Daytona, on the east by the unincorporated areas of Volusia County, the City of Daytona Beach, and the City of Daytona Beach Shores, and on the south and west by the unincorporated areas of Volusia County. The city is served by State Road 415, U.S. Route 1, Interstate 95, and the Florida East Coast Railway. The 1980 population of Port Orange was reported to be 18,756 (Reference 4).

Precipitation within the study area ranges from 48 to 64 inches per year. Due to hurricane activity, the precipitation range varies. The annual mean temperature for Port Orange is approximately 70 degrees Fahrenheit.


Ormond Beach
Ormond Beach
Ormond-by-the-Sea
Ormond Beach
Ormond Beach
Ormond Beach

2.3 Principal Flood Problems

Port Orange is subject to storm surge flooding as a result of hurricane and tropical storm activity. Flooding is caused by large tidal surges into the Halifax River/Intracoastal Waterway and by the heavy rainfall that accompany these storms.

Spruce Creek, B-19 Canal, and B-19 Canal Tributary Nos. 1 and 2 are subject to flooding during periods of heavy rainfall.

2.4 Flood Protection Measures

Flood protection measures are not known to exist within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community. Analyses were also carried out to establish the peak elevation-frequency relationships for each coastal flooding source studied in detail.

Regionalized regression equations developed by the U.S. Geological Survey in cooperation with the Florida Department of Transportation were used for deriving peak discharge-frequency relationships for Spruce Creek, and B-19 Canal Tributary Nos. 1 and 2 (Reference 5). Regionalized regression equations were slightly modified to represent the extensive swamp areas within the drainage basins of the streams by adjusting the lake storage term of the equation so that the computed peak discharges of 10-, 50-, 100-, and 500-year frequencies agree closely with the peak discharges resulting from the log-Pearson Type III analysis of the streamflow records. The

procedures outlined in U.S. Water Resources Council Bulletin 17B (Reference 6) were used in applying log-Pearson Type III distributions to the observed streamflow records.

The RUNOFF block of the U.S. Environmental Protection Agency's Stormwater Management Model User's Manual Volume III (SWMM) (References 7 and 8), as modified by Camp Dresser & McKee, was used to generate runoff hydrographs and to perform simplified lake/channel/conduit routing. Detailed information on the hydrologic parameters is contained in the study titled "Tomoka River and B-19 Canal 100-Year Flood Results for the City of Daytona Beach" (Reference 2). The drainage areas for the B-19 Canal were obtained from this model. The EXTRAN model (Reference 9) performs hydraulic routing in the downstream reaches of the watershed. The discharges for the B-19 Canal were obtained from the EXTRAN model.

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods for Spruce Creek, B-19 Canal, and B-19 Canal Tributary Nos. 1 and 2 are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
SPRUCE CREEK at Interstate 95	72.71	1,843	2,667	3,039	3,889
B-19 CANAL at Willow Run Boulevard	6.2	N/A	N/A	290	N/A
B-19 CANAL TRIBUTARY No. 1 at Interstate 95	0.92	111	210	261	420
B-19 CANAL TRIBUTARY No. 2 at mouth	0.25	44	85	107	180

Inundation from the Atlantic Ocean caused by passage of storms (storm surge) was determined by the joint probability method (Reference 10). The storm populations were described by probability distributions of five parameters that influence surge heights. These parameters were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of observed storms in the vicinity of the City of Port Orange. Primary sources of data for this analysis were Tropical Cyclones of the North Atlantic Ocean, 1871-1977, Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States, and Meteorological Criteria for Standard Project Hurricane and Probable

Maximum Hurricane Wind Fields, Gulf and East Coasts of the United States (References 11-13).

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 14).

The storm-surge elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the City of Port Orange and are shown in Table 2, Summary of Stillwater Elevations. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects but do not include the contributions from wave action effects.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses were obtained from field surveys (Reference 15).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Water-surface elevations for Spruce Creek were developed using the HEC-2 water-surface profile computer model (Reference 16). Water-surface elevations for B-19 Canal Tributary Nos. 1 and 2 were developed using the WSP-2 water-surface profile computer model (Reference 17).

The EXTRAN computer model (Reference 9) was used to calculate water-surface profiles for the B-19 Canal. EXTRAN is a hydraulic flow routing model for open channel and/or closed conduit systems. It uses a link-node representation of the drainage system in an explicit finite difference solution of the equations of gradually varied, unsteady flow. The EXTRAN model received hydrograph input at specific nodal locations by disk file transfer from the RUNOFF hydrologic model (Reference 8). The EXTRAN model performs dynamic routing of stormwater flows through the major storm drainage system to the points of outfall to the receiving water system.

FLOODING SOURCE AND TRANSECT	FLOODING INSURANCE RATE MAP PANEL	STILLWATER ELEVATION (FEET NGVD)				ZONE	BASE FLOOD ELEVATION[1,2] (FEET NGVD)
		10-YEAR	50-YEAR	100-YEAR	500-YEAR		
ATLANTIC OCEAN							
HALIFAX RIVER/							
INTRACOASTAL WATERWAY							
1,2	0005	4.7	6.2	7.0	9.8	AE	7–9
N/A	0010	3.4	5.4	6.4	8.6	AE	6

[1]ROUNDED TO THE NEAREST FOOT AND MAY INCLUDE EFFECTS OF WAVE ACTION
[2]DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PORT ORANGE, FL
(VOLUSIA CO.)

SUMMARY OF STILLWATER ELEVATIONS

ATLANTIC OCEAN—HALIFAX RIVER/INTRACOASTAL WATERWAY

Roughness coefficients (Manning's "n") used in the hydraulic computations were chosen on the basis of field observations and aerial photographs of the streams and floodplain areas. Roughness values used for the main channels ranged from 0.035 to 0.06 with overbank values ranging from 0.045 to 0.12.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The FEMA storm surge model was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 nautical miles, and 1,000 feet, depending on the resolution required.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (Reference 18). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by established procedures (Reference 18). The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 2, Transect Location Map, in accordance with the "Users Manual for Wave Height Analysis" (Reference 14). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed

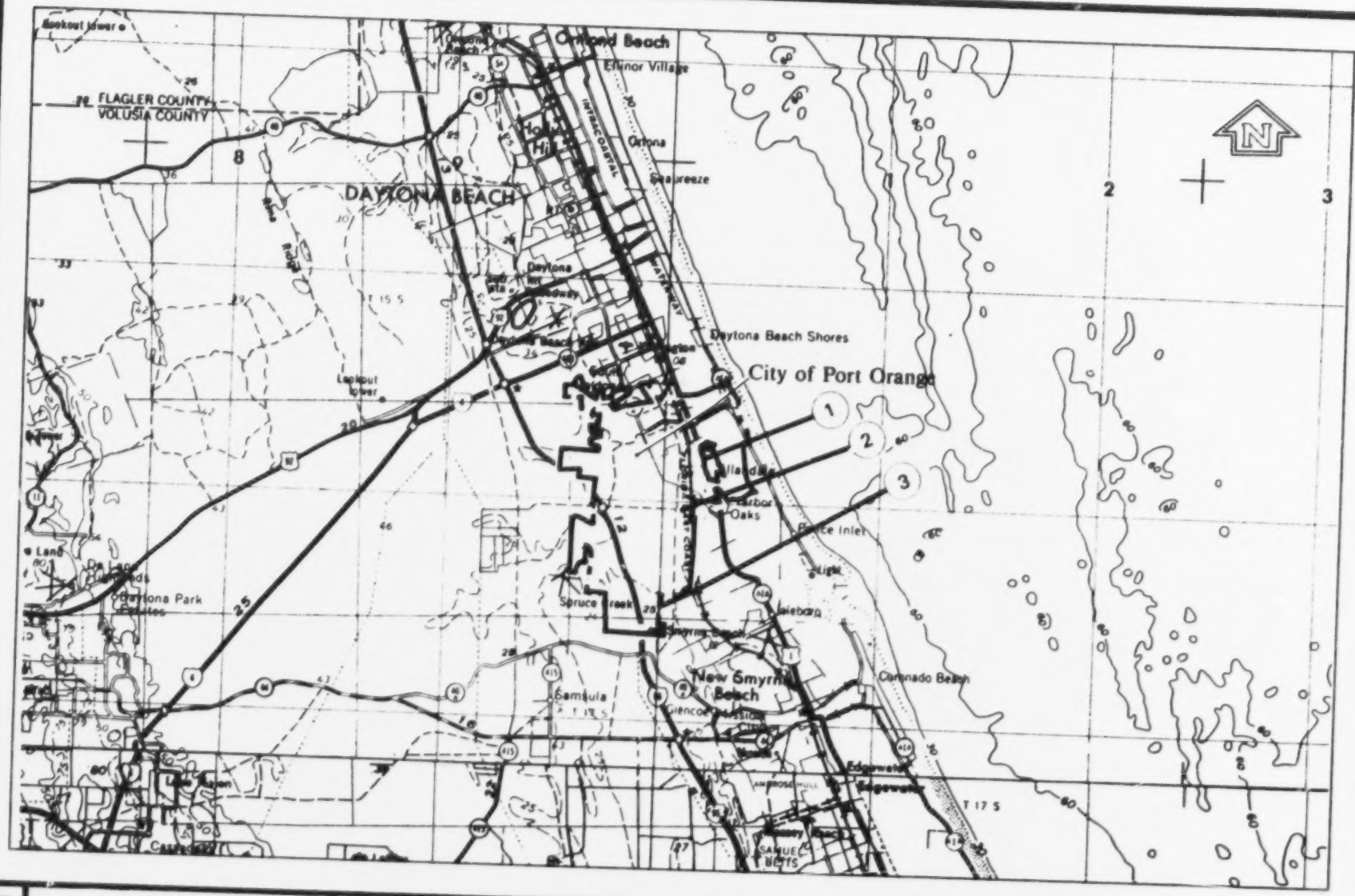


FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PORT ORANGE, FL
(VOLUSIA CO.)

APPROXIMATE SCALE
4 0 4 8 12 MILES

TRANSECT LOCATION MAP

and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was also computed at each transect. Table 3 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave crest elevations.

Figure 3 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the V/A zone boundary.

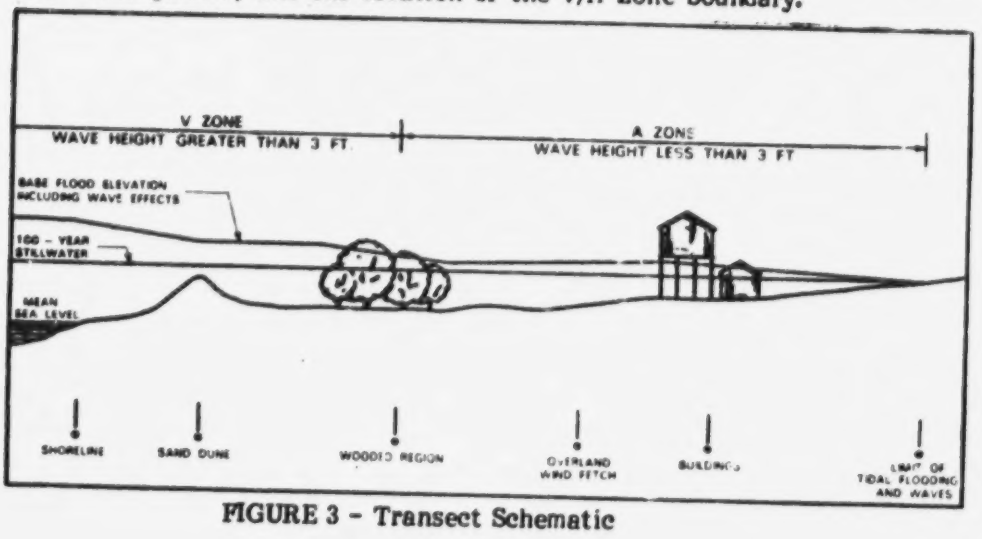


FIGURE 3 - Transect Schematic

TABLE 3 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS

TRANSECT	LOCATION	ELEVATION (FEET) STILLWATER	ELEVATION (FEET) WAVE CREST
1	Approximately 2,500 feet north of State Road 415 from the Atlantic coastline westward across the Halifax Creek/Intra-coastal Waterway floodplain	7.0[2]	8.0[2]

TABLE 3 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS

TRANSECT	LOCATION	ELEVATION (FEET) STILLWATER	ELEVATION (FEET) WAVE CREST
2	Between Venetian Way South and Marcelle Avenue from the Atlantic coastline westward across the Halifax River/ Intra-coastal Waterway floodplain	8.0[1]	12.0[1]
3	Approximately 850 feet south of Old Carriage Road from the Atlantic coastline westward across the Halifax River/ Intra-coastal Waterway floodplain into Volusia County between Main Street and Cedar Street	7.0[2]	8.0[2]

[1]Atlantic Ocean at the open coast

[2]Halifax River/Intracoastal Waterway

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (References 19 and 20), beach profiles (Reference 21), aerial photographs (References 22 and 23), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual

chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 19). Along the B-19 Canal, boundaries were delineated using topographic maps at a scale of 1:2400 with a contour interval of 1 foot (Reference 24). For each coastal flooding source studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each transect. Between transects, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 19).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the flooding sources studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 4, Floodway Data. The computed floodways are shown on

the Flood Insurance Rate Map. In cases where the floodway and the 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway for Spruce Creek lie outside the corporate limits.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

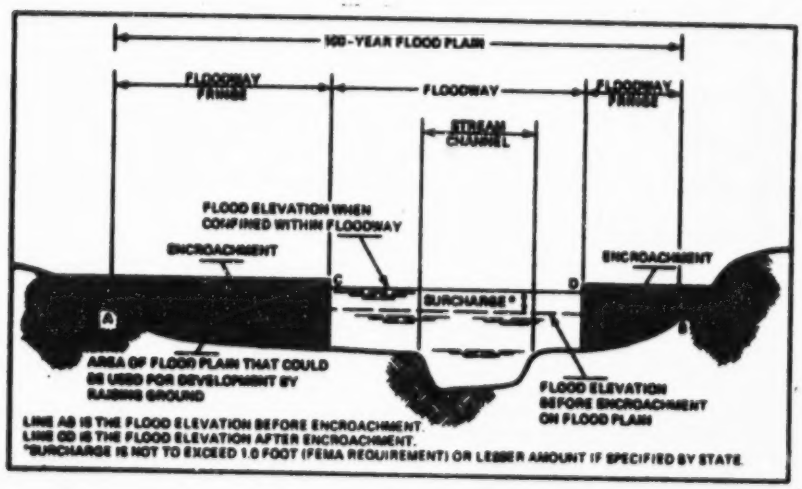

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 4 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SPRUCE CREEK								
A	19,100	299	2617	1.4	5.5	4.2[2]	4.9	0.7
B	24,525	228	2278	1.5	5.3	4.7[2]	5.3	0.6
C	29,050	481	2855	1.1	5.0	5.0	5.7	0.7
D	29,780	496	3149	1.0	5.1	5.1	5.8	0.7

[1]FEET ABOVE U.S. ROUTE 1
[2]ELEVATIONS WITHOUT CONSIDERING STORM SURGE EFFECT FROM STRICKLAND BAY

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PORT ORANGE, FL
(VOLUSIA CO.)

FLOODWAY DATA

SPRUCE CREEK

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 foot and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Flood Insurance Study published for the City of Daytona Beach Shores, Volusia County, Florida (Reference 25) is in agreement with this study.

Revisions in progress to the published Flood Insurance Studies for the Unincorporated Areas of Volusia County, the City of South Daytona, and the City of Daytona Beach, Florida (References 3, 26, and 27) are in agreement with this study.

This Flood Insurance Study supersedes the previously published Flood Insurance Study for the City of Port Orange (Reference 1).

A report, titled Tomoka River Flood Plain Management Study (Part II), B-19 Canal, Volusia County, Florida, (Reference 28), is in agreement with this study for B-19 Tributary No. 1 and B-19 Tributary No. 2.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

9.0 REFERENCES AND BIBLIOGRAPHY

1. Federal Emergency Management Agency, Flood Insurance Study, City of Port Orange, Volusia County, Florida, September 1984.

2. Camp Dresser & McKee, Inc., Tomoka River and B-19 Canal 100-Year Flood Results for the City of Daytona Beach, November 1988, revised March 1989 and January 1990.

3. Federal Emergency Management Agency, Flood Insurance Study, Volusia County, Unincorporated Areas, Florida, October 1983, revision in progress.

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FLOOD PROFILES

SPRUCE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PORT ORANGE, FL
(VOLUSIA CO.)

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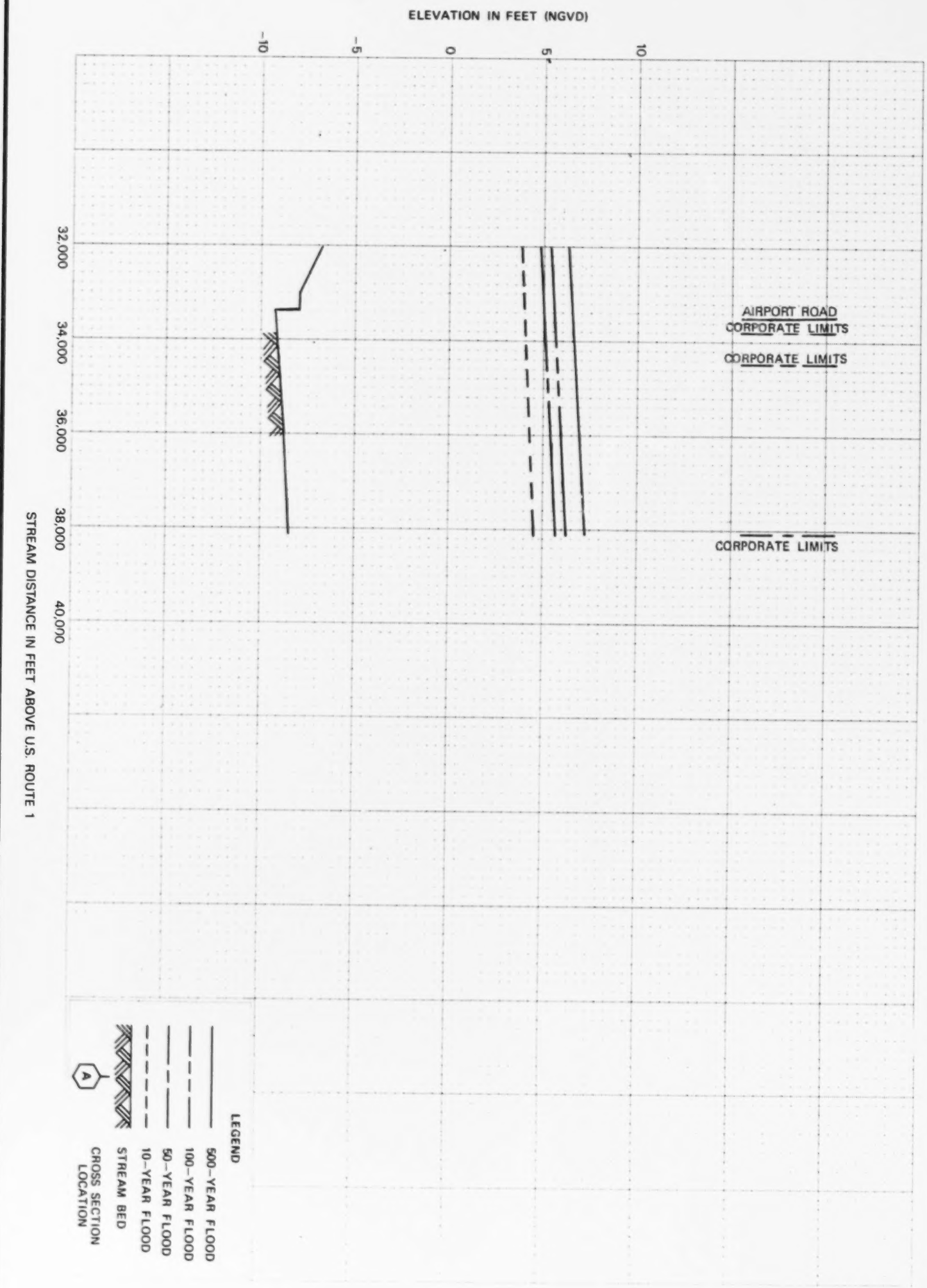

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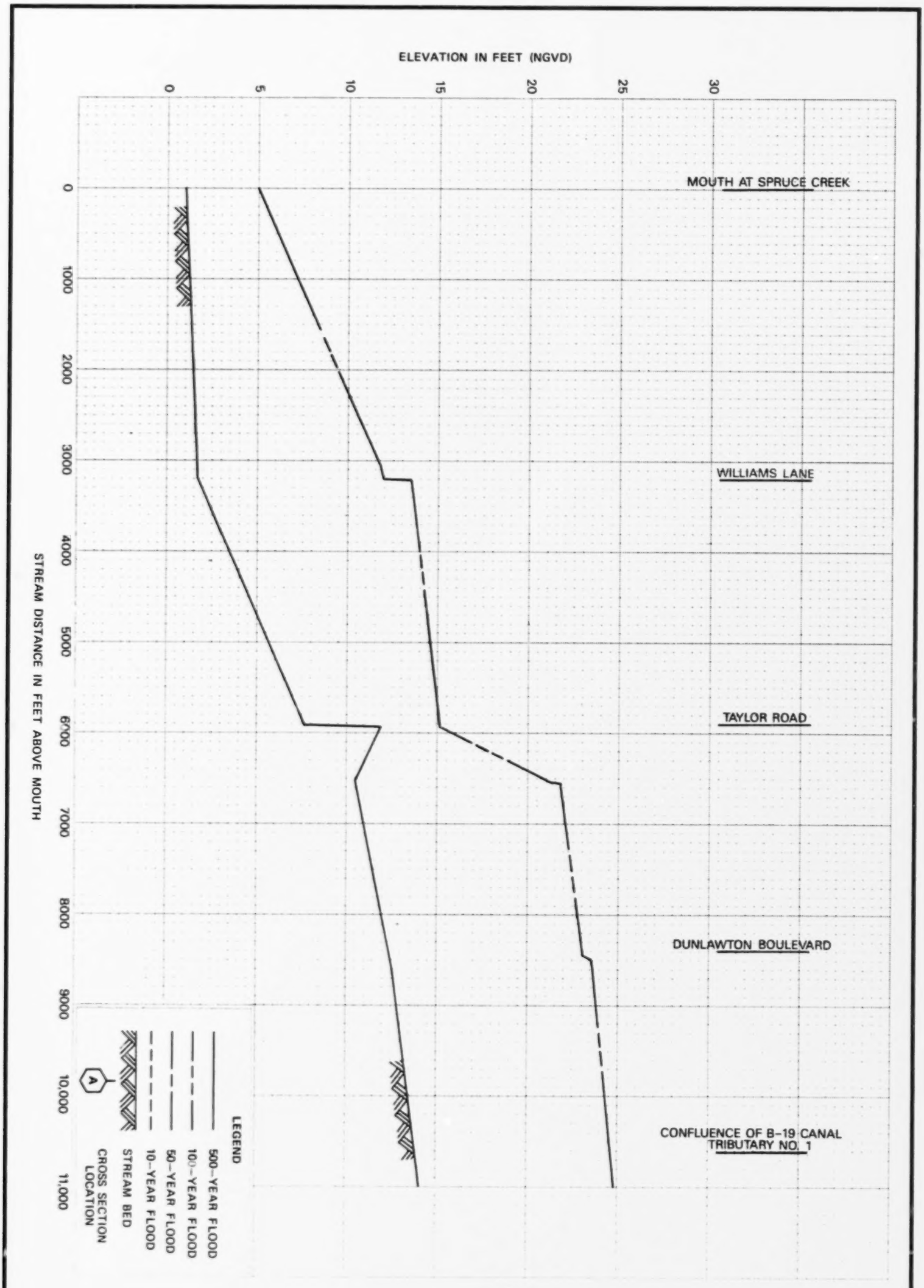

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FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PORT ORANGE, FL
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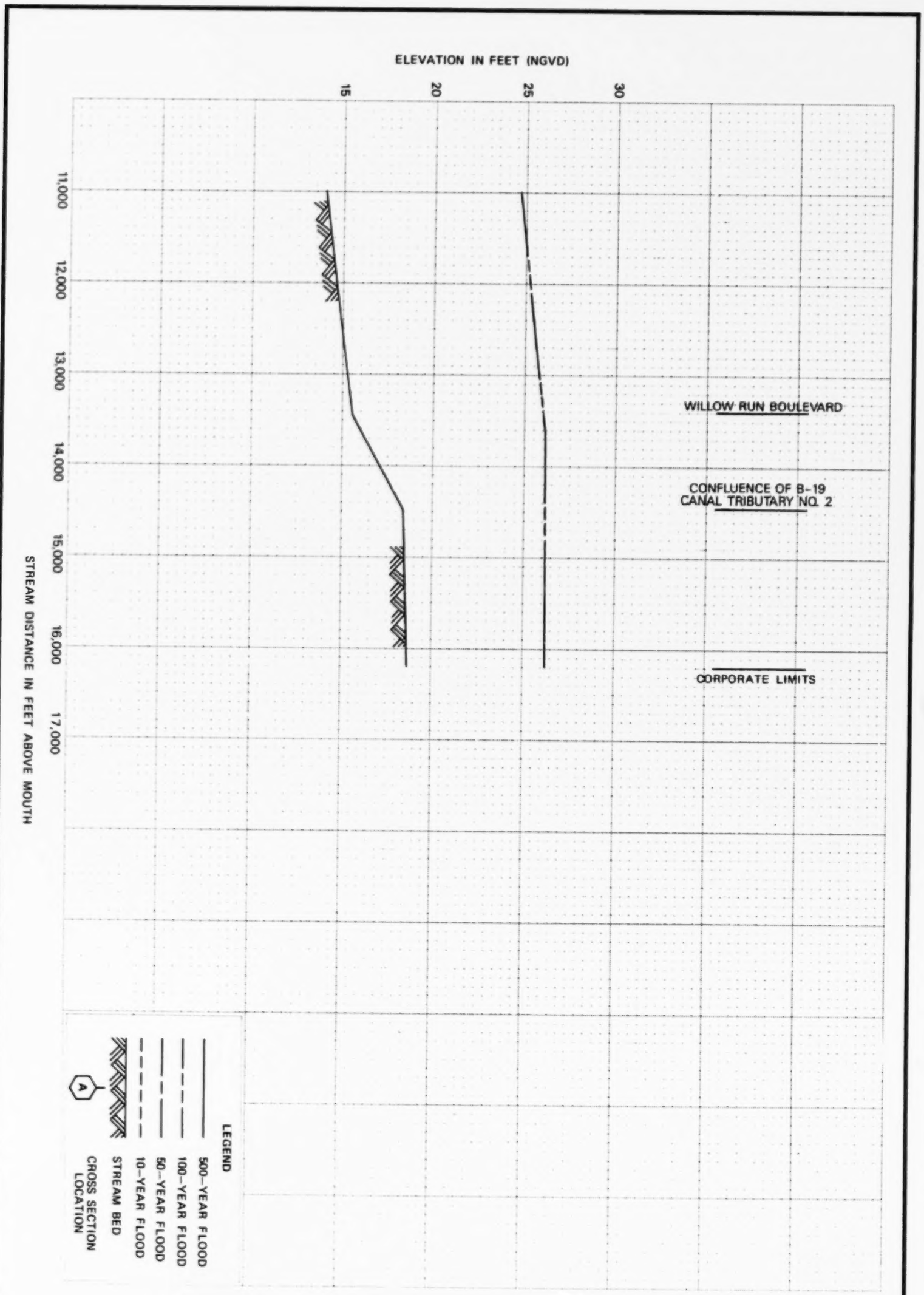
FLOOD PROFILES

B-19 CANAL



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FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PORT ORANGE, FL
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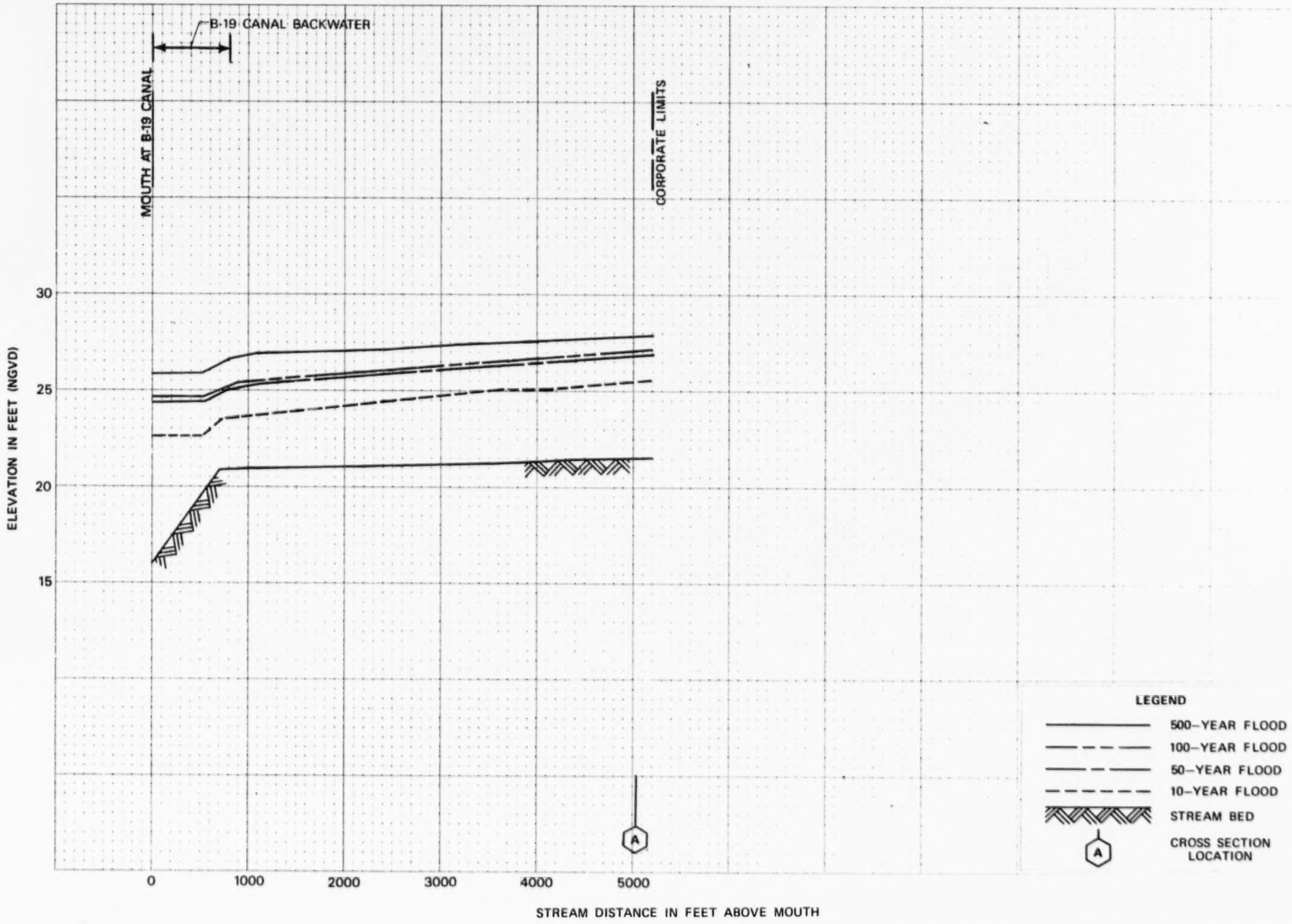
FLOOD PROFILES

B-19 CANAL



FLOOD PROFILES

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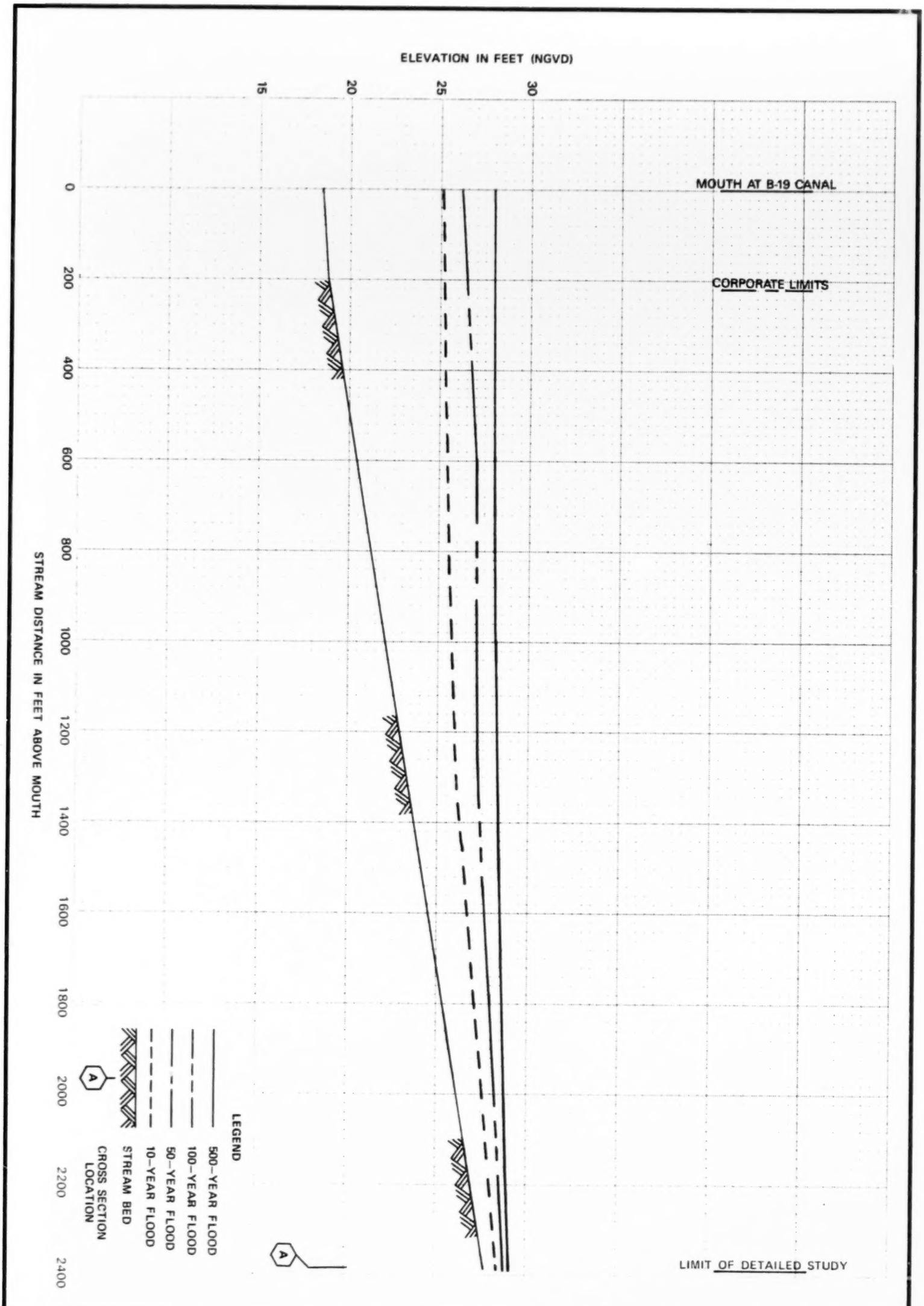

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FLOOD PROFILES

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